Navigation Sensor System Interface NAVSSI AN/SSN-6(V)

Waterfront GPS Users Conference



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2 November 2000

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Navigation Sensor System Interface



Two Main Functions:

- Collection, Processing, Integration and Distribution of Navigation Data to Weapon Systems, Combat Support Systems, C4ISR Systems, and other Information Systems Users
 - Embedded GPS VME Receiver Card (GVRC) In NAVSSI Block 3 Replaces
 AN/WRN-6
- Electronic Navigation/Charting/ Voyage Management
 - USCG-Developed Command Display & Control (COMDAC) Software
 - Embedded STELLA (System To Estimate Latitude & Longitude Astronomically)
 Celestial Navigation Software Segment



NAVSSI Inputs and Users



GPS Receivers

GVRC

Inertial Systems

AN/WSN-5 AN/WSN-7 **Speed Logs EM LOG**

DSVL

Other Sensors

Radar

Depth Sounder

Wind

Gvro

Flux Gate Mag Compass

NAVSSI

Point-to-Point

LANs: SWAN, ICAN, DMS/FODMS, ISNS

A Variety Of User Systems Including:

Weapons Systems Combat Systems

SSDS Mk 1 & 2 TWCS

ATWCS CEC

MK 86 GFCS **ACDS**

Mk 34 GWS AN/SQQ-89

ERGM

AN/SQS-53D

Other Systems

AN/TPX-42 AN/KSQ-1

GCCS-M **MORIAH**

Combat DF Outboard

COBLU **BGPHES**

T-RDF **BFTT**

CADRT



Real-Time Navigation Data



- PVT Data Critical to Weapon and C4I System Performance
 - Position, Heading, Speed, Attitude, Time and GPS Initialization Data

For Example:

SSDS Uses GPS Time From NAVSSI for Time Sync As Well As Course, Speed, Attitude and Wind Data for Weapon Systems Calculations



Evolution of NAVSSI



FUTURE

BLOCK

FUTURE

- HORIZONTAL INTEGRATION
- ANTI-JAM GPS ANTENNA
- ECDIS-N CERTIFICATION
- VOYAGE MANAGEMENT SYSTEM
- GPS MODERNIZATION
 - MODULAR H/W
 - NEW USER SYSTEMS

AEGIS DDG/ ELECTRONIC NAVIGATION

MK-34 GWS

COMDAC

- SSDS
- SQS-53D
- MORIAH
- ALI
- ICAN
- SWAN

- EMBEDDED GPS RECEIVER
- CELESTIAL NAVIGATION
- STANDARD NAV MESSAGES
- TIME EXPANSION PORTS
- KSQ-1
- NAV RADAR OVERLAY
- NAV OPERATIONAL REPORTS
- NETWORKED DISPLAYS
- TCS FOR UAV TIDES & CURRENTS

• CEC

RLGN

- FODMS
- SQQ-89
- ERGM
- BFTT
- DSVL
- TPX-42
- WIND

BLOCK 1/2

• ACDS

TAMPS/SLAM

BASIC CARRIERS/AMPHIBS

- MK86 GFCS
- FATHOMETER

- DUAL RTS
- JMCIS LAN

CORE SYSTEM

- TOMAHAWK
- **GYROCOMPASS**

- INERTIAL NAVIGATION
- JOTS

- GPS
- OUTBOARD
- EM LOG



Electronic Charting in Navigation



- Naval Safety Center Five-year Study Attributes \$120M of Repair Cost to Collisions And/or Groundings That Could Have Been Avoided With Automated Systems
 - 12 of 61 Collisions And/or Groundings FY95-FY99
 - Average Yearly Repair Cost: \$24m/year







N6 Tiger Team Recommendations



VADM Mayo Formed a Tiger Team to Examine the Problem. Recommendations Were:

- Accelerate, Where Feasible, COMDAC Upgrades to NAVSSI Equipped Ships
- Field a Relatively Low Cost COMDAC-Based System on Those Ships Which Do Not Require a Full NAVSSI Suite and Which Otherwise Would Not Have ECDIS-N Capability
- Encourage Litton and Raytheon to Continue Their Efforts to Upgrade Current and Planned Installations to a Full ECDIS-N Capability
- NIMA Continue to Offer FUND As a Situational Awareness Aid to Navigation



N6 Evaluation Results



- 4 Nautical Electronic Charting Applications Examined
- Although Important, WECDIS Requirements Not Evaluated
- Commercial Software Great for Situational Awareness, However Most Will Not Ever Meet ECDIS-N Requirements

	FUND	COMDAC	Raytheon	Litton
Charts Display	Green	Green	Yellow	Green
Set and Drift	Red	Green	Red	Yellow
LOPs	Red	Green	Red	Yellow
Route Planning	Yellow	Green	Green	Green
Safety Contours	Red	Yellow	Green	Green
Collision	Yellow	Green	Green	Green
Voyage Record	Green	Green	Green	Green



NAVSSI and Electronic Charting



In the Beginning:

- Electronic Charting in the NAVSSI OR, But PVT Reqs Overshadowed
- Leveraged NSSN Decision to Use CG's COMDAC
 - Robust Functionality
 - Commonality and Resource Sharing

To the Forefront:

 ECDIS-N policy; DDG/CVN VMS reqs; Fleet Clamoring for Electronic Charting; COMDAC Judged Better Than Available Commercial Solutions!

"Fleet Wants and Needs Electronic Charting Now!"

Say: VADM Mayo, RADM West and RADM Rutherford



Charting and Voyage Management By USCG's COMDAC (Partnerships & Platforms)



Thirteen Coast Guard FAMOUS Class Cutters With Potential for Installation on Other Cutters.





At Least 169 Combatants Will Have NAVSSI Installed, Including NIMITZ Class Aircraft Carriers, ARLEIGH BURKE Class Destroyers, TICONDEROGA Class Cruisers, and WASP Class Amphibious Assault Ships.

VIRGINIA Class New Attack Submarines (NSSN), for Its Navigation Data Distribution and Display (ND3) System.





NAVSSI/COMDAC Capabilities



- Voyage Planning & Monitoring
 - Great Circle to Rhumb Line Track Voyage Planning.
 - Full Waypoint Capability
 - PIM and ETA Calculations/labeling
 - Dynamic Calculations for ETA
 - Detailed Own Ship Data Window
 - Standard Navigation Report
 - Selectable Track Leg Deviation Limit
 - Dynamic Turnpoint (Slidebar/Wheelover)
 - Turn Bearings/Ranges From Objects
 - Electronic Bearing Line/Variable Range Marker
 - Precision Anchoring
- Charts and Displays
 - NIMA DNC and NOAA-approved RNC Charts
 - Six Day/night Color Palates
 - WGS-84 Datum/Datum Conversion

- Position Sources
 - GPS
 - Inertial Navigation Systems
 - Integrated GPS/INS
 - Astronomical (STELLA)
 - Visual/Radar/Combination
 - Radar Chart Matching Overlay
 - Manual
 - Running fix
- Automatic Radar Plotting Aid (ARPA)
 - Target Tracking
 - Collision Avoidance
 - Predicted Areas of Danger
 - Predicted Point of Collisions
- Man overboard function (SAR Based)
- Tides, Currents & Almanac Data/Display
- Level 5 DII COE Interoperability
- Data Logging
 - 28 Items

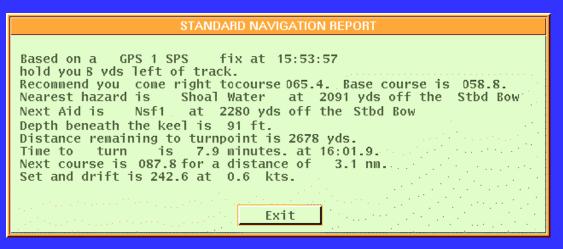


Piloting Guidance



Automatically Calculates:

- Cross-track Error
- Recommended Course to Steer Accounting for Set/drift
- Nearest Hazard
- Next Navigation Aid
- Depth
- Distance and Time to Turn



Military Standard Navigation Report



Tabular Turnpoint Solution Data

Electronic Fix Positioning and Automated Conventional Piloting Methods

Electronic Navigation Fix Sources

- GPS
- INS

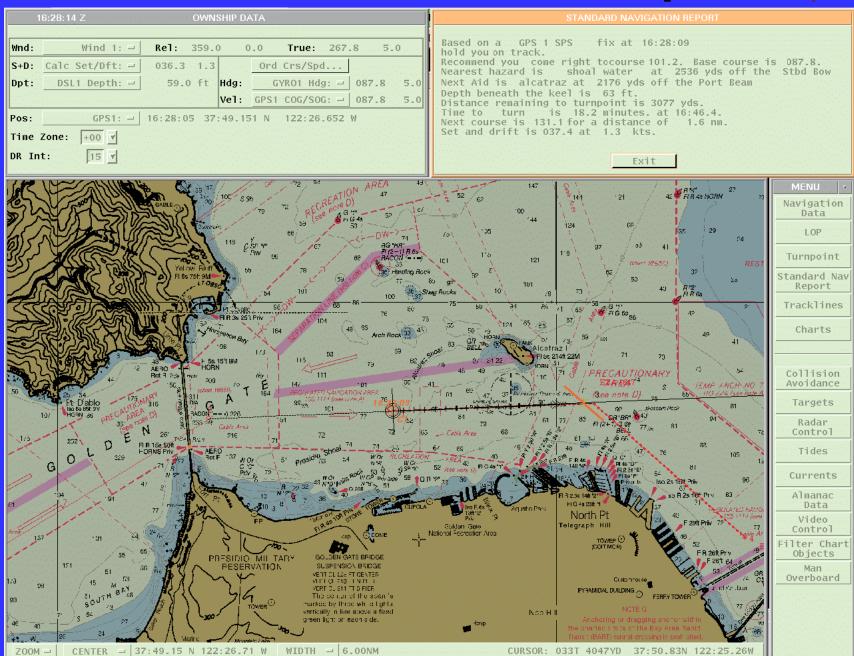


Automated conventional piloting with Lines-of-Position (LOP)

- Visual Bearing LOP Fix
- Radar Range LOP Fix
- Combined Visual and Radar LOP Fix

NAVSSI-COMDAC Workspace

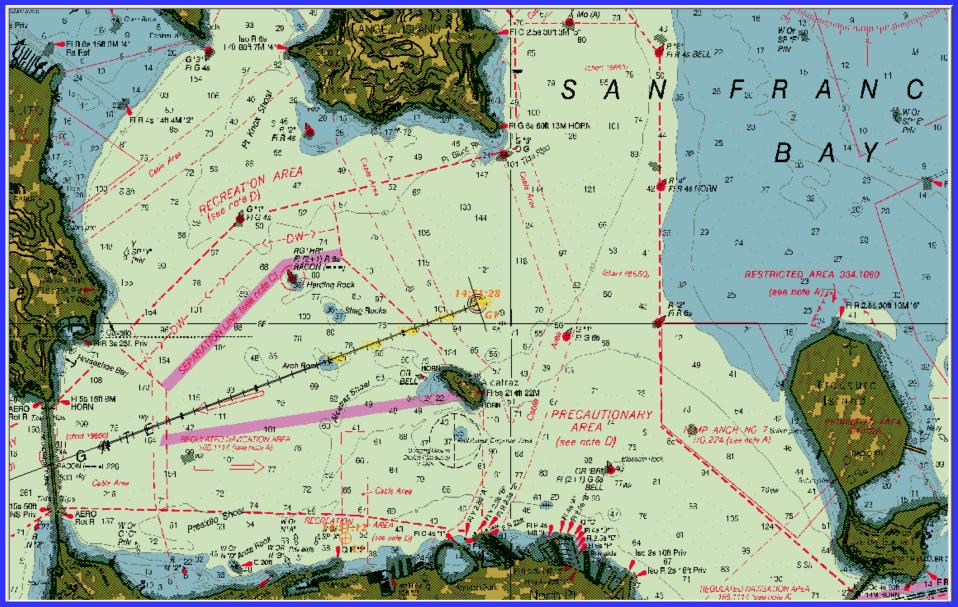






Radar Overlay

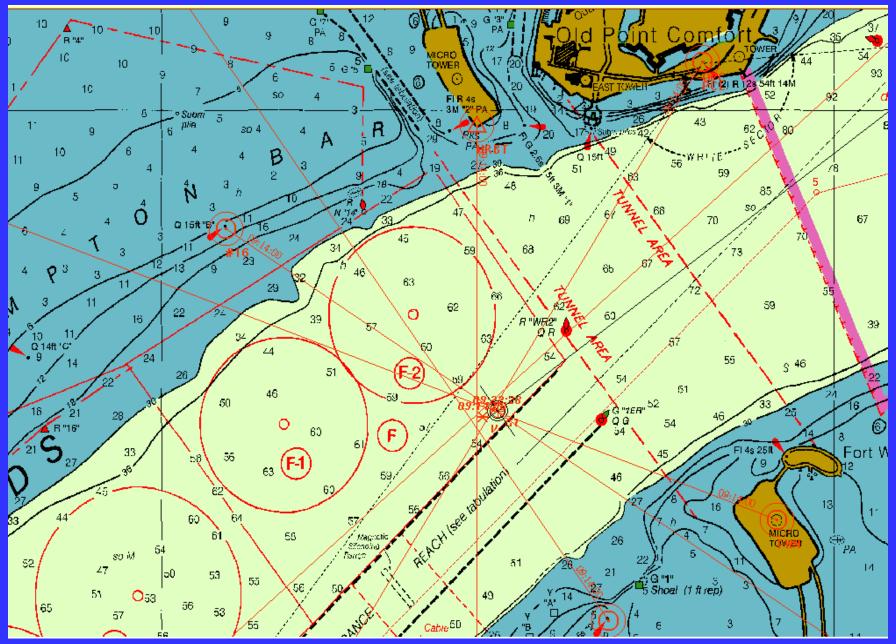






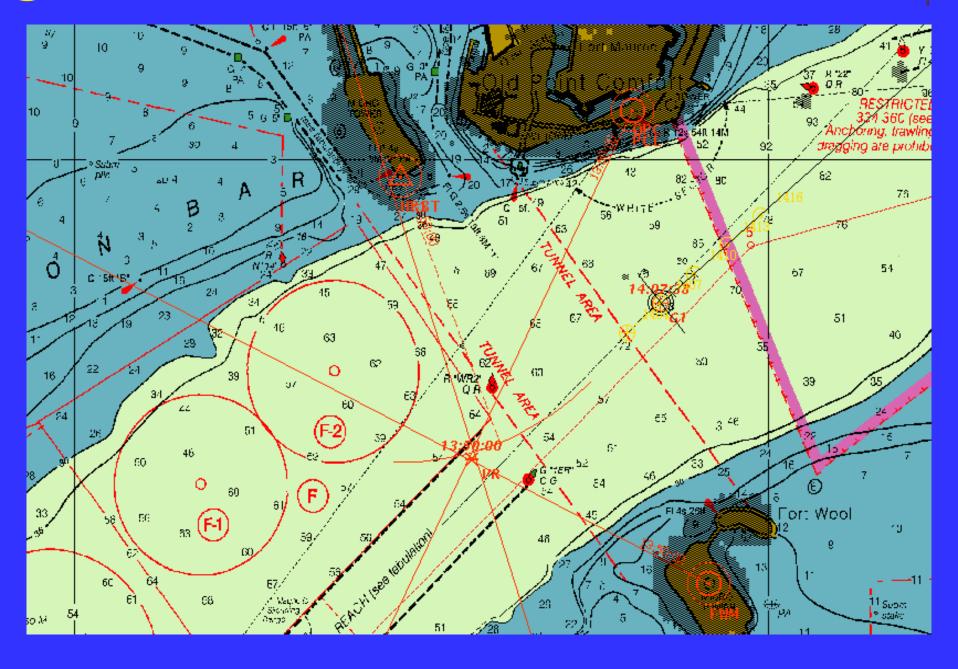
Visual Bearing LOP Fix





Combined Visual and Radar LOP Fix

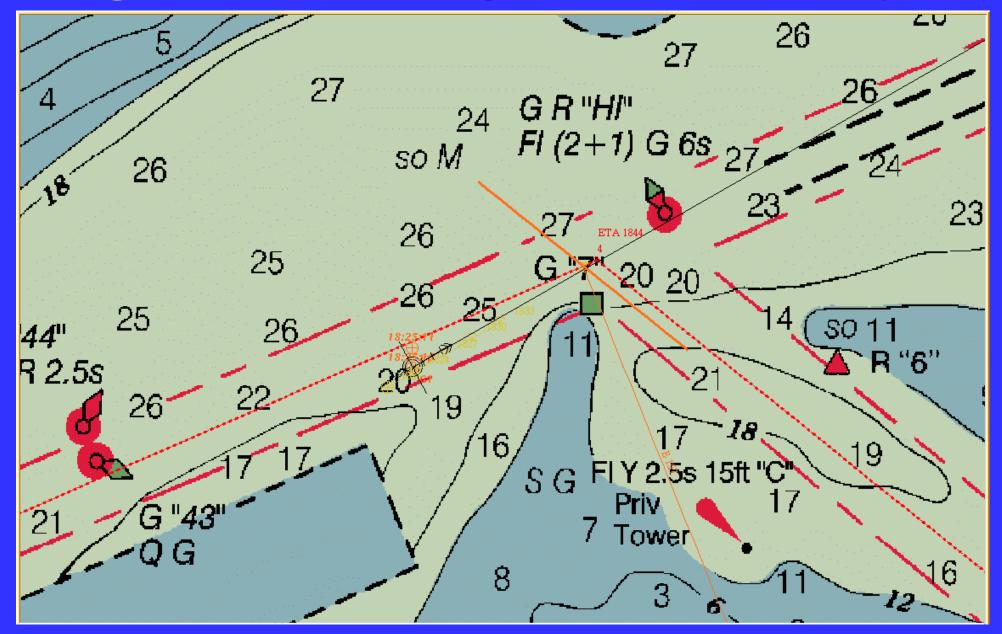






Turnpoints

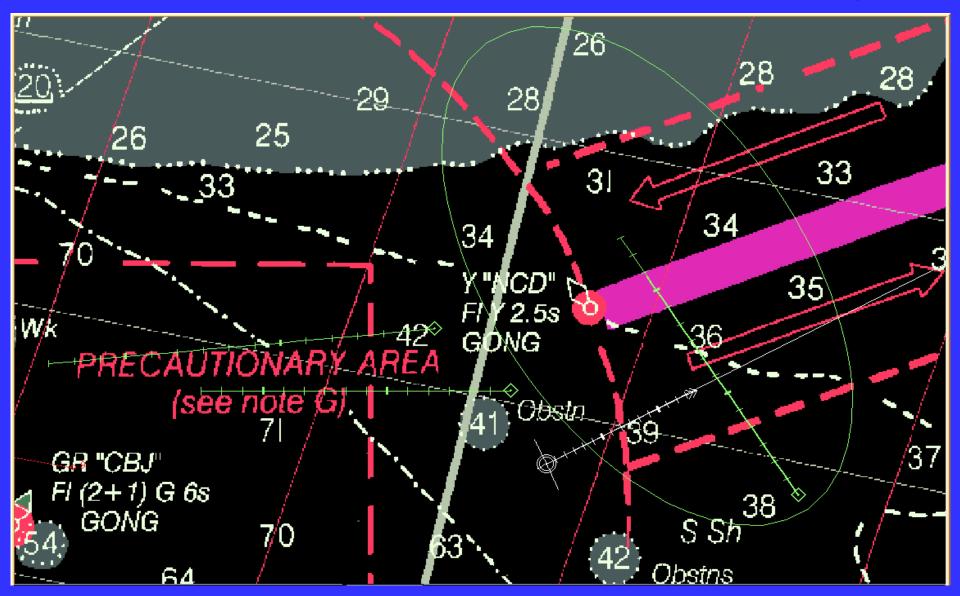






Collision Avoidance



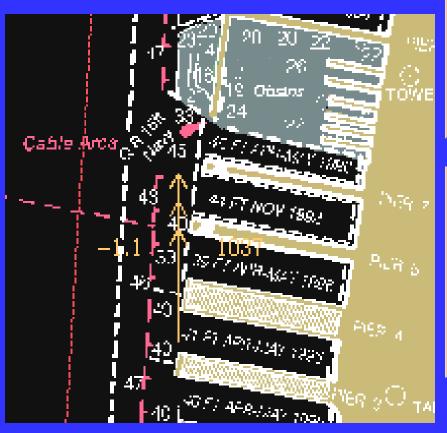


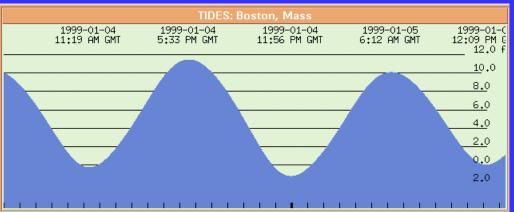


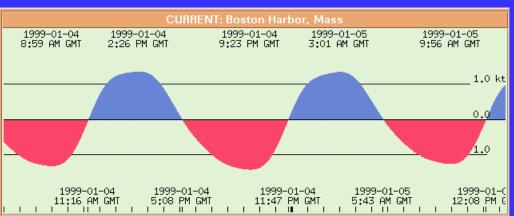
Tides and Currents



Displayed on the Chart...





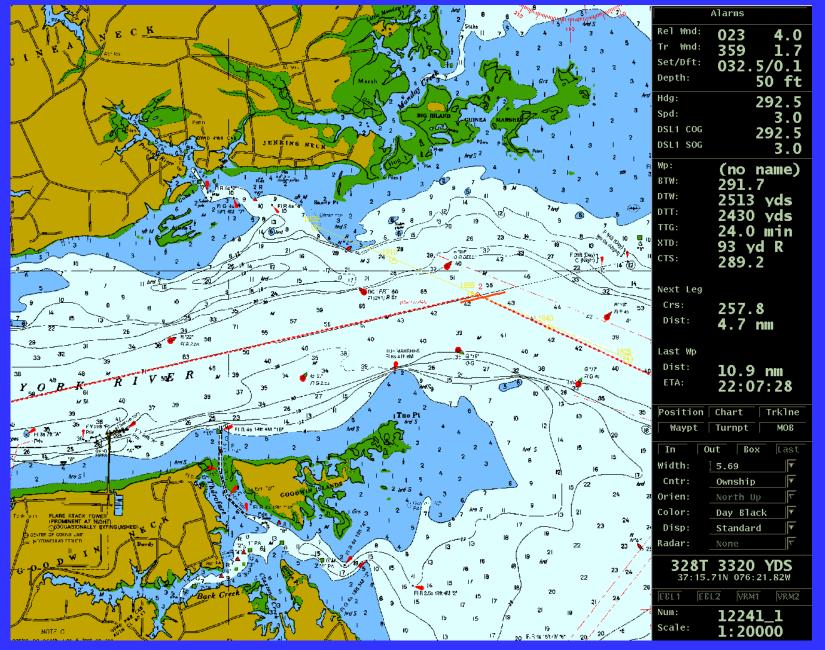


...And Graphically in Pop-up Windows.



ECDIS-N Screen







Road to ECDIS-N



1998	ECDIS-N Policy Letter Signed
2000	Fleet CINCs Update Priorities for DNC Coverage and Maintenance
	Fleet CINCs Submit Integrated Navigation System MNS
	ECDIS-N Certification Requirements and Processes Approved
	NIMA Completes World-Wide Chart Digitization
	NAVSSI ECDIS-N Precursor Fielded
2001	Fleet CINCs Revise Navigation Policy, Standards and Instructions
	NIMA Completes, validates and implements DNC VDU Process
	NTSPs are Implemented for ECDIS-N Systems
2002	NIMA DNCs of Navigation Quality Available for Limited Areas
	NAVSSI, CADRT, COTS Systems Pass OPTEST/NAVCERT
	Fleet CINCs Certify 1st Ship ECDIS-N
2004	NIMA World-Wide DNC Database of Navigation Quality

2007 Navy Goal: Fleet-Wide Paperless Electronic Charting

VIRGINIA Class Submarine Sails Without Paper Charts



NAVSSI Training Overview



- Looking to Improve NAVSSI Training at the School Houses (FTC/FCTC/AESD/SWOS) and Aboard Ship
 - TTE (Technical Training Equipment) and CAI (Computer Aided Instruction)
 - On-board Operator and Maintenance Training at Install
- NAVSSI NTSP Approved 13 OCT 00
 - QM (ECDIS-N) and ET (ISM) NECs
 - Refresher Training for Senior QMs
 - Information Systems Maintainer (ISM) Course
- We Are Injecting Priority Into NAVSSI Training!



NAVSSI Operator Training



- Establish ECDIS-N/NAVSSI Operator's NEC and COI
- ECDIS-N NEC QM-02XX (ECDIS-N) awaiting CNET Designation
- Course Curriculum Model Manager (CCMM): Navigation School, Fleet Training Center (FTC), San Diego, CA
- Locations: Navigation School, FTC San Diego, CA and Navigation School, FTC Norfolk, VA



NAVSSI Maintenance Training



- Fold Maintenance Training Into ISM COI
- NEC ET-1678 Information Systems Maintainer (ISM) (FY-01 NTSP Update) -Pilot Course Planned for 08 JAN 2001 (FCTC)
 - ISM Will Identify Systems Approach to Maintaining Current Configuration of GCCS-M and NAVSSI (Pilot Course - 9 Weeks, E4-E9)
- CCMM: Fleet Combat Training Center (FCTC), Dam Neck, VA
- Location: Maintenance School, FTC San Diego, CA (Formerly Advanced Electronics School (AES)



NAVSSI - The Bottom Line



- You (The Fleet) Want Capability and Support
 - Distributed Position, Velocity and Time
 - Situational Awareness Leading to ECDIS-N
 - Operator and Maintenance Training

- NAVSSI Will Meet Your Needs
 - Premier PVT Source for Navy Ships
 - COMDAC Electronic Charting Leading to ECDIS-N
 - Training on the Ship and at the Schoolhouse



Navigation Systems Points of Contact



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Back-Up Slides



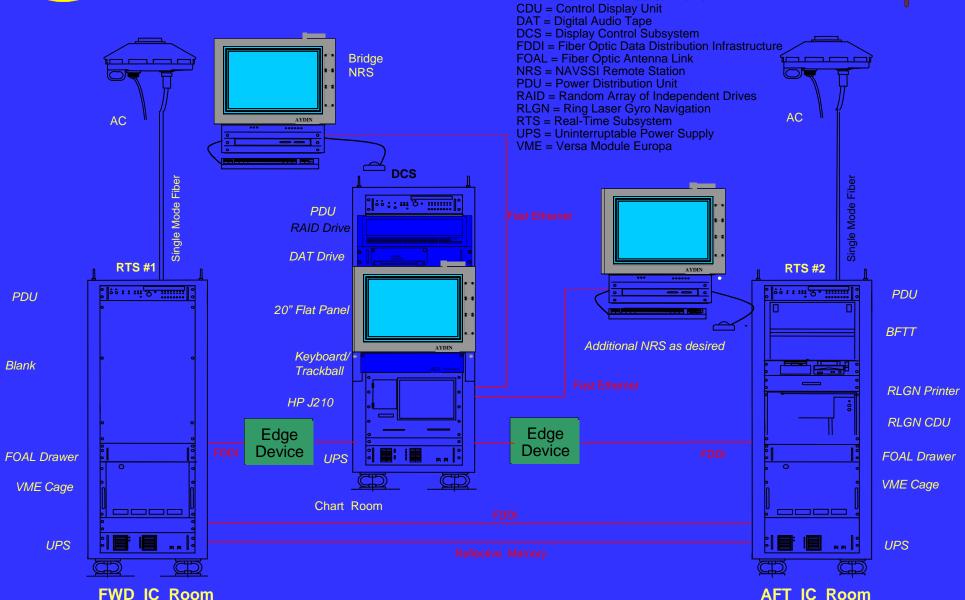
Back-Up Slides



NAVSSI Hardware

BFTT = Battle Force Tactical Trainer







Why Not Use a Commercial ECDIS?



Merchant vessels are well suited to the commercial Electronic Chart Display & Information System (ECDIS) paradigm





Military vessels steam to more stringent navigation standards and cannot rely on systems that depend on the availability of electronic navigation sources. Traditional positioning and dead reckoning methods must be available when external sensors are unavailable.